IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Shubneesh Batra et al.	§		
	§	Group Art Unit:	Unassigned
Prior Application Serial No.: 09/059,663	§		
Prior Application Filed: April 13, 1998	§		
	§		
Serial No.: Unassigned	§	Examiner:	Unassigned
	§		
Filed: Herewith	§		
	§		
For: LOW TEMPERATURE REFLOW METHOD FOR FILLING HIGH ASPECT RATIO CONTACTS	§	Atty Docket:	MCRO:199--3/FLE 95-0057.03

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July 10, 2001 — *Date*

Cynthia L. Hayden

Assistant Commisioner
For Patents
Washington, D.C. 20231

Dear Sir:

PRELIMINARY AMENDMENT

Prior to examination of the above-referenced application, please amend the above-identified application as follows:

IN THE SPECIFICATION

Please insert the following paragraph immediately after the title:

--GOVERNMENT LICENSE RIGHTS

The U.S. Government has a paid-up license in this invention and the rights in limited circumstances to require the patent owner to license others on reasonable terms as provided for by the terms of Contract No. MDA972-92-C-0054 awarded by the Advanced Research Projects Agency (ARPA).--

Please amend the specification by inserting before the first line the sentence:

--This application is a Continuation of application Serial No. 09/059,663, filed April 13, 1998, which is a Continuation of application Serial No. 08/631,445, filed April 12, 1996, which issued on August 4, 1998 as U.S.P.N. 5,789,317.--

IN THE CLAIMS

Please cancel claims 2-29 without prejudice.

Please add new claims 30-65 as set forth below.

30 (new). A method of forming a contact, the method comprising the following steps performed in order:

(a) providing a substrate having a contact hole formed therein, the contact hole exposing a portion of a conductive area of the substrate;

(b) depositing conductive material comprising aluminum into the contact hole, the conductive material having a melting point;

(c) depositing an impurity into the contact hole, the impurity causing the melting point of the conductive material to lower; and

(d) reflowing the conductive material and the impurity.

31 (new). The method, as set forth in claim 30, wherein the conductive material is deposited within a temperature range of about 300 degrees Celsius to about 500 degrees Celsius.

32 (new). The method, as set forth in claim 30, wherein said impurity is derived from an impurity source containing at least one of silicon, germanium, a halogen, a metal, and a metal-based material.

33 (new). The method, as set forth in claim 30, wherein step (c) comprises the step of depositing impurities which migrate out of the contact hole.

34 (new). The method, as set forth in claim 30, wherein step (c) comprises the step of depositing impurities which do not migrate out of the contact hole.

35 (new). The method, as set forth in claim 30, wherein step (c) comprises the step of lowering the melting point of the conductive material by 10% to 60%.

36 (new). The method, as set forth in claim 30, wherein step (c) comprises the step of depositing the impurity continuously during step (b).

37 (new). The method, as set forth in claim 30, wherein step (c) comprises the step of depositing the impurity intermittently during step (b).

38 (new). The method, as set forth in claim 30, wherein the impurity is deposited after 70% of the conductive material has been deposited.

39 (new). The method, as set forth in claim 30, wherein steps (b), (c), and (d) are performed simultaneously.

40 (new). A method of forming a contact, the method comprising the steps of:

(a) providing a substrate having a contact hole formed therein, the contact hole exposing a portion of a conductive area of the substrate;

(b) depositing conductive material into the contact hole, the conductive material having a surface tension; and

(c) depositing an impurity onto the conductive material at a temperature that causes the conductive material to reflow, the impurity causing the surface tension of the conductive material to lower.

41 (new). The method, as set forth in claim 40, wherein the conductive material comprises at least one of aluminum, aluminum alloy, tungsten, tungsten alloy, titanium, titanium alloy, copper, and copper alloy.

42 (new). The method, as set forth in claim 40, wherein the impurity is derived from an impurity source comprising at least one of silane, disilane, germane, GeF_4, SiF_4, Cl_2F_2, ClF_3, ICl_3, ICl_5, $TiCl_4$, WF_6, and $TaCl_5$.

43 (new). The method, as set forth in claim 40, wherein step (c) comprises the step of depositing impurities which migrate out of the contact hole.

44 (new). The method, as set forth in claim 40, wherein step (c) comprises the step of depositing impurities which do not migrate out of the contact hole.

45 (new). The method, as set forth in claim 40, wherein step (c) comprises the step of depositing the impurity continuously during step (b).

46 (new). The method, as set forth in claim 40, wherein step (c) comprises the step of depositing the impurity intermittently during step (b).

47 (new). The method, as set forth in claim 40, wherein the conductive material comprises aluminum, wherein the impurity is derived from $TiCl_4$, and wherein the impurity is deposited after 70% of the conductive material has been deposited.

48 (new). A method of filling a feature having a high aspect ratio, the method comprising the steps of:

(a) depositing conductive material into the high aspect ratio feature, the conductive material having a surface tension; and

(b) depositing an impurity onto the conductive material at a temperature that causes the conductive material to reflow, the impurity causing the surface tension of the conductive material to lower.

49 (new). The method, as set forth in claim 48, wherein the conductive material comprises aluminum and is deposited within a temperature range of about 300 degrees Celsius to about 500 degrees Celsius.

50 (new). The method, as set forth in claim 48, wherein said impurity is derived from an impurity source containing at least one of silicon, germanium, a halogen, a metal, and a metal-based material.

51 (new). The method, as set forth in claim 48, wherein the conductive material comprises at least one of aluminum, aluminum alloy, tungsten, tungsten alloy, titanium, titanium alloy, copper, and copper alloy.

52 (new). The method, as set forth in claim 48, wherein step (b) comprises the step of depositing an impurity which tends to remain in place with the conductive material deposited therewith.

53 (new). The method, as set forth in claim 48, wherein step (b) comprises the step of depositing an impurity which tends to migrate from a place relative to the conductive material deposited therewith.

54 (new). The method, as set forth in claim 53, wherein step (b) comprises the step of depositing an impurity which migrates out of the high aspect ratio feature.

55 (new). The method, as set forth in claim 53, wherein step (b) comprises the step of depositing an impurity which disperses throughout the conductive material.

56 (new). The method, as set forth in claim 48, wherein step (b) comprises the step of lowering the melting point of the conductive material by 10% to 60%.

57 (new). The method, as set forth in claim 48, wherein step (b) comprises the step of depositing the impurity continuously during step (a).

58 (new). The method, as set forth in claim 48, wherein step (b) comprises the step of depositing the impurity intermittently during step (a).

59 (new). The method, as set forth in claim 48, wherein the impurity is deposited after 70% of the conductive material has been deposited.

60 (new). A method of forming a contact, the method comprising the steps of:

(a) providing a substrate having a contact hole formed therein, the contact hole exposing a portion of a conductive area of the substrate;

(b) depositing conductive material into the contact hole, the conductive material having a surface tension; and

(c) depositing an impurity which does not migrate out of the contact hole onto the conductive material at a temperature that causes the conductive material to reflow, the impurity causing the surface tension of the conductive material to lower.

61 (new). The method, as set forth in claim 60, wherein the conductive material comprises at least one of aluminum, aluminum alloy, tungsten, tungsten alloy, titanium, titanium alloy, copper, and copper alloy.

62 (new). The method, as set forth in claim 60, wherein the impurity is derived from an impurity source comprising at least one of silane, disilane, germane, GeF_4, SiF_4, Cl_2F_2, ClF_3, ICl_3, ICl_5, $TiCl_4$, WF_6, and $TaCl_5$.

63 (new). The method, as set forth in claim 60, wherein step (c) comprises the step of depositing the impurity continuously during step (b).

64 (new). The method, as set forth in claim 60, wherein step (c) comprises the step of depositing the impurity intermittently during step (b).

65 (new). The method, as set forth in claim 60, wherein the conductive material comprises aluminum, wherein the impurity is derived from $TiCl_4$, and wherein the impurity is deposited after 70% of the conductive material has been deposited.

REMARKS

Claims 2-29 have been canceled without prejudice, and Applicants have added new claims 30-65. Consideration of the application as amended is respectfully requested.

If the Examiner believes that a telephonic interview will help speed this application toward issuance, the Examiner is invited to contact the undersigned at the number listed below.

General Authorization for Extensions of Time

In accordance with 37 C.F.R. § 1.136, Applicants hereby provide a general authorization to treat this and any future reply requiring an extension of time as incorporating a request therefor. Furthermore, Applicants authorize the Commissioner to charge the appropriate fee for any extension of time to Deposit Account No. 13-3092; Order No. MCRO:199--3/FLE (95-0057.03).

Respectfully submitted,

Date: July 10, 2001

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